Information Technology

Abstract. Forging an unprecedented partnership between the public and private sectors is essential to protect the vital interests of the United States in the wake of the ongoing Information Technology Revolution. This study will define the Information Technology Industry, give an overview of current domestic and international conditions, and then analyze the state of national network security and challenges faced by the United States government and U.S. and international businesses and corporations in building a secure, yet productive and innovative partnership. Particular emphasis will be placed on industry issues with national security implications.

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I. Introduction.

The United States Information Technology (IT) industry was a major contributor to the growth of the U.S. economy throughout the '90s. Over the last decade, the American economy has grown faster with lower inflation than at anytime since the Vietnam War - largely due to advancements of IT systems and resultant productivity enhancements benefiting most U.S. industries.

Virtually every American industry has benefited from advances in information management and IT. Simply put—in the New Economy, America's economic competitive advantage is really an IT advantage. IT contributions are not limited to America's economic base; IT is also helping to transform the U.S. military from a Industrial Age platform-based force, into an Information Age, fully networked, capabilities-based force. Every military service transformation plan relies heavily upon IT as a means to substitute speed and precision for mass. Given our heavy dependence on IT and the great importance of the IT industry, the question becomes how do we promote a healthy, robust, and growth-oriented IT industry. This paper examines the IT industry, specifically the current health of the industry, and current challenges. Additionally, this paper will examine the role of government in addressing these challenges and ensuring the United States maintains a worldwide IT advantage. The 2004 IT Industry Study Group based this study on field research in the U.S., Ireland, China, Thailand, Singapore and Japan, as well as extensive research.

II. DEFINING THE INFORMATION TECHNOLOGY INDUSTRY

The Information Technology (IT) industry cannot be defined or captured by a single company or a single sector of our nation's economy. The Department of Commerce defines the IT-producing industries as those industries "…that procure, process, or transmit information goods and services" [i] It includes goods-producing industries related to the Internet and electronic commerce, manufacturers of some general and specialized electronic components, computers and peripheral equipment, specialized measuring and testing instruments, telecommunications equipment and pre-packaged software. It also includes those industries that provide computer, software, and telecommunications services. To better evaluate the IT industry, the Commerce Department divided it into four sectors using its North America Industry Classification System: (1) hardware industries, (2) software/computer service industries, (3) communications equipment industries, and (4) communication services industries.

General Economic Conditions

After two years of retrenchment, the IT-producing industries are showing signs of resuming the dynamic roles they played during 1996 – 2000[ii] (shown in Figure 1). Through the later portion of the 1990s, the IT industry grew steadily at about an overall 11% average annual growth rate, reaching a peak of $878B in 2000. With the "dot.com" bubble collapse and the worldwide recession following the events of September 11, 2001, the IT industry fell 5.6% in 2001 to $828B. In 2002, while the general economy started to recover from the mild recession, the IT portion recovery was delayed due to the low business spending for capital equipment.[iii] It grew only 0.3% in 2002 to $831B. Recovery in the IT industry began in the second half of 2003, with an estimated 11.5% gain in the fourth quarter[iv] and a 4.8% annual gain for 2003 ($878B).[v] This pickup was

attributed to four factors: (1) an improved macroeconomic picture with favorable monetary conditions, (2) long overdue pre-Y2K desktop replacement cycle along with a need to improved security and lower cost of ownership, (3) a shift towards portable, wireless computing, and (4) stable cost of application software packages.[vi]

While the overall IT industry improved in 2003, performance by sector varied widely (shown in Figure 2). The hardware sector showed the largest growth of 9.8%. However, communications equipment, which had fallen over 15% in 2002, slowed its declined 5.6%. The service sector continued their slow and steady growth with a 1.6% rise in software and services and 7.2% growth in communications services.[vii]

IT employment, which fell sharply during the 2001-2002 downturn, has been slow to recover. Over 600,000 jobs were lost.[viii] Contributing factors were the 2001 recession, labor saving productivity improvements, and foreign outsourcing of jobs. However, despite the pickup in the overall economy in 2003, the job market for IT workers remained weak.

In contrast to the changes in IT production and employment, IT industry investment in Research and Development (R&D) has shown greater stability.[ix] Although the overall company R&D spending was flat for 2001 at about $181B, R&D for IT companies grew in 2001 from $46.9B to $56.5B, according to the latest available data from the National Science Foundation. [x] (Illustrated in Figure 3). More than other industries, IT is heavily reliant on R&D investment to drive the innovation required for market leadership.

The outlook for 2004 is for IT to continue to its recovery. According to the Prudential Financial Securities' proprietary survey of U.S. and European CIOs conducted in the first quarter 2004, respondents showed continuing confidence about long-term IT growth with mid-single to lower double digits percentage forecasts.[xi] IT budgets for 2004 have remained stable or up slightly from the previous year.[xii] CIO Magazine's Tech Poll conducted in February 2004 showed similar results.[xiii] Another positive factor is the enlargement of the European Union. The ten new member states added May 1, 2004 create a greater, single market for IT goods and services.[xiv] Growth in trade with eastern Asia (principally China) is expected to continue to outpace the rest of the world. Finally, worldwide use of the Internet will continue to grow driving demand for both goods and services.

Sector Analysis – Hardware (Computers and Networking)

Contribution to GDP: From 2002 to 2003, Hardware contribution to GDP increased 9.9 % from $189.3B to $208.0B. Hardware represents 1.9% of the total 2003 GDP. This sector comprises 23.9% of the IT Total in 2003.

Computers. This segment has three main components: personal computers (PC) (including notebooks), which accounts for 91% of total revenues, servers (including mainframes and supercomputers) 6.4%, and workstations 2.5%.[xv]

Market Composition

The PC industry is becoming increasingly concentrated. In 1992 the top 10 worldwide vendors accounted for roughly half the market. By the third quarter of 2003, the top five vendors increased their hold to 48%[xvi]: Dell (17.4%), Hewitt Packard (17.1%), and IBM (5.9%).[xvii]

In the server industry the top five vendors command 84% of the market share in 2002. The top two leaders are IBM (29.5%) and Hewitt Packard (27.9%). Sun Microsystems market share slipped (13.6%) while recent entry Dell gained (8.2%). Fujitsu Siemens showed a modest decline (3.5%).[xviii]

In the workstations segment the prognosis for growth is nil. Lower priced and more powerful desktop computers are providing a compelling and cheaper alternative.

Current Environment

PCs have become largely standardized, with the overwhelming majority being built with processors based on the Intel design and using Microsoft software. Due to this lack of product differentiation, price becomes the key differentiator. With increased competition, only the most cost-efficient vendors will survive. Consequently, PC vendors are broadening their product lines by entering consumer electronic markets (plasma and LCD televisions, digital cameras, and digital music players, etc.) with higher profit margins. Server sales, after nine quarters of annual declines, rose 17.5% in the second quarter of 2003. Revenues, however, remained flat—reflecting price competition.[xix]

Forecast

Computer hardware spending represents some 40% of worldwide spending on IT. IT spending is expected to grow from nearly $1.0 trillion in 2001 to $1.5 trillion in 2006.[xx] Much of this growth is due to the Internet, both in the building of its infrastructure and for devices to access it. With an expected real GDP growth of 4.6% in 2004, PC sales are expected to expand 8% to 11% in 2004. Continued growth in a range of 7-12% for 2005 to 2008 is reasonable.[xxi] Much of this growth will come from international markets, and offer long-term growth with the Asia-Pacific region exploding at a compound annual rate of 14.1%, while the United States is expected to grow at a more modest 7.0%.[xxii]

With increasing price competition in PCs, further consolidated is expected. Many industry forecasters have predicted that the top five PC vendors may hold 70% market share in the near future.[xxiii]

Prospects for server sales are uncertain. While servers sales in the U.S. are expected to grow 2.8% in 2004, oversea sales are expected to lag due to weak corporate spending environment and tight technology budgets.[xxiv]

Traditional workstations that use the Unix operating system and reduced instruction set computer microprocessor will continue to be challenged by the influx of PC-based units, as well as increased competition from the lower-priced Windows NT workstations.[xxv]

Networking

Market Composition. Five main product lines make up this sector, producing IT infrastructure equipment such as ethernet switches, routers, access equipment, mobility equipment, and optical transport equipment.[xxvi]

The market leaders in each product line (based on 4th quarter 2002 revenues):

1. Ethernet switches and wireless LAN — Cisco (60%)
2. Routers — Cisco (49%)
3. Access Equipment — Alcatel (22%)

4. Mobility Equipment — Ericsson (28.5%)
5. Optical transport equipment — Nortel (19.5%)

Current Environment

Standard and Poor's assesses the current environment as an "…uncertain economy and excess network capacity due to prior over-investment." This "over-investment" has slowed the recovery from the 2000 – 2002 downturn.[xxvii] Of the five segments, only Ethernet switches showed growth with a modest 3%.[xxviii]

Forecast.

Standard & Poor's believes that this sector may see a recovery in 2004 and 2005 with annual sales growth of 8% to 12%, followed by annual growth rates of 10% - 15% over the next three to five years.[xxix] Increased use of the Internet will continue to drive demand from networking equipment. International Data Corporation forecasts that Internet worldwide usage will rise from 500 million in 2001 to nearly one billion by 2006.[xxx] New applications such as streaming video and desire for greater bandwidth and transmission capability will drive investment in infrastructure.[xxxi]

Consolidation within this industry is expected to continue. The industry's largest players have found that purchasing small start-up firms specializing in emerging technologies is more effective than developing their own products internally.[xxxii] For example, Cisco acquired 48 companies from 1993 – 1999, and another 23 in 2000. Merger activity slowed in 2002 and 2003 due to the economic downturn. However, with prospects for a recovering economy, companies may want to take advantage of the more reasonable current valuations and acquire additional holdings.

Computer Software, Services, and Internet

Contribution to GDP: From 2002 to 2003, the software and services sector contribution to GDP increased 1.6% from $323.7B to $328.8B. This represents 3.0% of the total 2003 GDP. This sector comprises 37.7% of the IT Total.

Computer Software: Software continues to play an increasingly important role in all sectors of the world's rapidly evolving high-technology society. The flow of information in today's global economy runs on software developed and supplied by Microsoft and a several competitors.

Market Composition: Microsoft continues to dominate the US and world software markets, with $24,666,000,000 in revenue in 2002. Surprisingly, a hardware giant is second: IBM sells a huge volume of software, recognizing that as hardware functionality increases, so does demand. EDS, Accenture, Oracle, and NTT Corporation follow Microsoft and IBM.[xxxiii]

Current Environment: After the dramatic "dot-com" bust of 2000-2001, IT spending continued to languish through 2002 (in the wake of 9/11 and the looming war with Iraq). IT spending in general, however, and software sales in particular, have shown steady improvement since the second quarter of 2003. Throughout the bust and the extended recovery, Microsoft continued "trucking along"—increasing market share and maintaining profitability. The "dwarfs" of the software industry, therefore, have borne the brunt of the bust, and disproportionately languished through the slow (if steady) recovery.

Linux continues to gain traction as an alternative source for enterprise servers such as business supply chain management, human resource management, financial records,

customer relations, Web services, and Employee Relationship Management (ERM). For the foreseeable future, however, Linux will likely remain a niche competitor with Microsoft.

Forecast: The software industry is changing rapidly. "Middleware," which serves as "workhorse" between the clients on the front end and databases on the back end, is quickly gaining popularity, especially in "business to business" sales. BEA Systems and IBM lead sales in this software sub-market. Likewise, Nintendo and Sony continue to dominate the lucrative "interactive entertainment" or video game software sub-market, despite Microsoft's aggressive marketing of X-Box systems. Finally, IBM is committed to developing hardware that operates on both open source software (most commonly Linux sold under General Public Licenses, or "GPL") and proprietary source software—much to Microsoft's chagrin.

These seemingly innocuous chinks in Microsoft's armor may indicate a loss of dexterity. Traditional software companies must continue to innovate or lose market share to more nimble competitors. In spite of Microsoft's near monolithic position atop the software industry, several sub-markets show signs of competition, and corresponding innovation.

Commercial Services

Spending on consulting and systems integration spending took a significant downturn from 2000 through 2003. With the steady recovery of the US economy since the first quarter of 2003, spending on IT services has correspondingly increased.

Market Composition: The IT Services market is widely diversified. According to Gartner Dataquest, IBM has a 7.5% market share, Electronic Data Systems 3.9%, Fujistu 2.7%, and Hewelett-Packard 2.3%. Several hundred other firms scramble for the remaining 83.6%.[xxxiv]

Current Environment: Not surprisingly, this highly fragmented and competitive market drives razor thin profit margins. Many smaller IT consulting firms were forced out of business after the dot-com crash. Those that survived started with or developed diversified revenue streams. Outsourcing and off-shoring, particularly to India, is a popular tactic to offset spiraling costs caused by fierce competition, high labor expenses, and unfavorable tax laws. In spite of these challenges, the net effects of globalization, deregulation, and technological innovation drive up demand word-wide, thereby benefiting US companies.

Forecast: The US economy experienced a solid turnaround in 2003, and more IT-related projects will be approved as customers emerge from more guarded postures. Standard and Poor's projects that the growth rate on commercial spending on IT services will more than double in 2004. The expansion of the IT services market will continue for the foreseeable future, with federal, state, and local government IT spending driving much of the expansion.

Consumer Services and Internet

Market Composition: According to Standard and Poor's, the top five Web Parent Companies in the United States are Microsoft, America on Line (previously AOL Time Warner), Yahoo, Google, and eBay. If the United States government were a company, it would be the sixth largest web parent company! While the "big 6" have a

solid hold over approximately 60% of the field, over 20 "mid-level" companies such as eUniverse, EarthLink, and Landmark Communications aggressively jockey for position.

Current Environment: The three-year downturn in Internet stocks ended in the first half of 2003. TheStreet.com Internet Index reported a 74% drop in Internet-based company stocks in 2000, followed by a further 56% drop in 2002. Two hundred eighty-three Internet companies discontinued operations between the first quarter of 2000 and the final quarter of 2003, resulting in over 150,000 IT job losses in the US.[xxxv] Rising stocks from January 2003 to the present, however, indicate that this market correction is over. For e-commerce, business-to-business (B2B) sales still dwarfed business-to-consumer (B2C) sales in 2003.

Forecast: Standard and Poor's predicts steady growth for Consumer Services and the Internet. Several fortunate factors converge in support of this prediction: PC prices continue to decline, the number and quality of web services continue to grow exponentially, and governments across the globe promote policies to stimulate and sustain Internet growth.

Sector Analysis – Communications Equipment

Contribution to GDP: From 2002 to 2003, Communications Equipment contribution to GDP decreased 6.8 % from $46.6B to $43.5B. This sector represents 0.4% of the total 2003 GDP. This sector comprises 5.0% of the IT Total.

Market Composition: In general, this industry provides the equipment to transmit voice, data and video services. The most interesting feature in the market for communications equipment is technology convergence. What used to be a market split by different technologies into different networks is now moving to linked sets of networks capable of delivering the same or similar services.[xxxvi] Data, voice and video will soon be available from various sources such as cable, wireless, wireline, and satellite, which means that companies that would not have been head-to-head competitors in the past will increasingly compete against each other. So wireline (phone and cable) leaders such as Alcatel, Lucent, Nortel, and Cisco will increasingly compete with wireless leaders such at Motorola, Lucent, Nokia and Ericsson to provide cross-cutting digital technology equipment.[xxxvii]

Current Environment: Following the telecommunications bust, recent Commerce Department indicators show that demand for communication hardware will stabilize during 2004.[xxxviii] This implies slow sales growth tied to the overall pace of the US economic recovery. With the on-going convergence, it is difficult to determine market share since the definition of the market itself is in flux. This is leading companies in this sector to move outside their traditional comfort zone to pursue a market strategy that provides a variety of digital services via their products. Traditional measures of performance (return on investment, return on equity, etc.) may also be less important during this convergence phase. Just as important will be breadth of technology offerings (data, voice, video) that are appealing enough for companies to remain a player in a converged communications equipment market.

Forecast: In sum, the market is increasingly characterized more by the specific services provided than by the technology or delivery medium. This convergence process is enabled by new technologies that allow previously narrow companies to provide wider offerings. Such technologies include Internet telephony, 2.5G and 3G wireless, fixed

wireless (Wi-Fi and Wi-Max), and enhanced wireline service over cable, telephone and power lines.[xxxix]

III. ENCOURAGING SECURITY AND COMPETIVE ADVANTAGE

As reported to Congress in "Security in the Information Age: New Challenges, New Strategies Joint Economic Committee United States Congress," our enemies are looking for our weaknesses: "It is very important to concentrate on hitting the U.S. economy through all possible means . . . look for the key pillars of the U.S. economy. The key pillars of the enemy should be struck . . ." Osama Bin Laden, December 27, 2001[xl]

U.S. Risks, Threats, and Vulnerabilities

Cyber attacks are daily events, and they are also increasingly more evasive and damaging to computers and networks. As the number of attacks continues to rise, the number of vulnerabilities in both software and hardware also rise.[xli] Networked computers now control everything from railways to pipelines to electric power grids, and present "malicious actors" increasing opportunities to cause disruption.

Threats and Vulnerabilities can be divided into five different levels for assessment and mitigation:

1. Home User / Small Business;
2. Larger Enterprises (including Universities);
3. Critical Sector / Infrastructures;
4. National;
5. Global;[xlii]

Network Security: Defending networks today requires coordinated private and government action. A solid foundation is needed to protect infrastructures from worms, viruses, Trojan horses, and other threats that can cause extensive damage before they are even identified.

In the past three years, government systems have been illegally entered approximately 250,000 times. The Defense Information Security Agency (DISA) found that 88% of assaults could have been easily prevented. DISA also maintains that only very small number of attacks on DoD systems were reported and investigated.[xliii] It is generally understood that a successful cyber attack on most DoD systems would cause hardly any casualties, but could cause loss of infrastructure and service.

The Government Accounting Office (GAO) has identified problems within the federal government and is tracking risks within 24 large federal agencies. GOA reports:

> "For many years, we have reported that poor information security is a widespread problem with potentially devastating consequences. Further, since 1997, we have identified information security as a government wide high-risk issue in reports to the Congress—most recently in January 2003."[xliv]

Almost every aspect of American life and government has become increasingly dependent on computer technology. The economy is increasing dependant on electronic

transactions. In the rapidly evolving world of technology, new forms of cyber terrorism will certainly appear.

How safe are our networks? Cyber attacks can be launched from anywhere in the world.

According to the Federal Trade Commission (FTC), five years ago the number of identity theft complaints was around 23,000. By 2001, the rate had more than tripled to about 86,200. Figures for 2003 rose to 215,000. [xlv]

The recent "Slammer" worm hit 55 million hosts in about 11 minutes. Blaster" struck about 128 million systems in 3 minutes. During the 2002 calendar year, the DoD Computer Emergency Response Team (CERT) detected, analyzed, and responded to more than 46,000 "events" on DoD's unclassified networks.[xlvi]

The physical threats are many, and wireless technology opens other potential seams. Wireless technology hacking techniques are cheap and plentiful. Wireless can increase the number of connections and multiply poor security practices. Even when wireless access points are secured by software, if the physical security is poor, hackers can "borrow" open access points. Time is on the side of intruders—even before new updates or patches can be installed, intrusions can cause costly and sometimes irreparable damage. Perimeter defenses are unable to fully protect networks, as many intruders are smart enough to get through them.

Services provided by network security companies can eliminate almost all of the false alarms typically generated by internal security devices, and can also stop real security breaches and network attacks faster.

A Strategy to Secure Cyberspace: The DISA information strategy is based on the theory that appropriate security actions will stop most of the cyber attacks. These protective mechanisms include physical, electronic, and procedural mechanisms. The main objectives of the plan are to 1) "prevent cyber attacks against America's critical infrastructures, 2) reduce national vulnerability to cyber attacks, and 3) minimize damage and recovery time from cyber attacks that do occur."[xlvii]

Several large and small private sector corporations offer assistance and expertise to the public sector. As an example, SECNAP Network Security Corporation, a network security service provider experienced in private and government sectors of the telecom industry, is presenting an integral part of the cyber security strategy for the Homeland Security Department for Critical Infrastructure Security. The aim is to deliver Precise Attack Prevention service including a 24x7 Firewall, network monitoring, External Penetration Testing, Security, Audits and Network Security Consulting Services.[xlviii]

Public-private partnerships at all levels of government are now supporting information security. At the federal level, the National Cyber Security Alliance (NCSA) is a cooperative effort between industry, industry associations and government organizations. NCSA's mission is to provide education and foster public awareness of cyber security protection methods and technologies through its web page: www.staysafeonline.info.

Cisco Self-Defending Network Initiative: The Cisco Network Admission Control program is a new development in the Cisco Self-Defending Network Initiative, a

new security strategy designed to improve the ability of networks to identify, prevent and adapt to a range of security threats. The Cisco Self-Defending Network Initiative advances Cisco's strategy of integrating security services throughout Internet Protocol (IP) networks by delivering new network threat defense. It also ties leading anti-virus software to its network hardware, thereby transforming access ports into security checkpoints. This approach shifts security architecture from network protection to user and device level protection and identifies and prevents malicious behavior before it can occur.

The three largest anti-virus software vendors, Network Associates, Symantec and Trend Micro, promise they will include the licensed Cisco Trust Agent in client security products. Trend Micro, which intends to include the Trust Agent directly in its anti-virus software by the middle of next year, expects Cisco's approach to dramatically reduce worm effectiveness. McAfee, with Nortel, is working on projects to block desktop users without anti-virus updates.

Recommendations: 1. The best way to counter cyber threats is through prevention. 2. Intensify Internet security by improving screening processes and advanced security passwords. 3. Support cooperation among security agencies in tracking and locating cyber terrorists by sharing information about cyber threat inside or out of their own country. 4. Frequently update current systems and anti-virus software. 5. Institute a permanent scan for viruses, worms, and any other tools to prevent the spread of viruses and/or other methods of Internet attacking; and update intrusion detection systems and firewalls to stop any cyber terrorists/hackers that pass through the "check-point."

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Open Source Software and Proprietary Source Software Development

Open source software is software that is built and extended through open public collaboration.[xlix] The source code for the software is freely available and anyone can use, modify and redistribute it.[l] It is considered the opposite of proprietary software, however, it is important to recognize that open source software is not "freeware" in that it is typically distributed under a license that specifies the rights and responsibilities of users.

One of the most popular open source licenses is the General Public License (GPL)[li], which allows users to modify and redistribute the code as long as they do not charge a fee for the modified software.[lii] Open source software development is an evolutionary and transparent process characterized by flexibility to add new features and low up-front costs. Advocates maintain open source software provides better security, since security gaps can often be found and fixed quicker than proprietary software. On the other hand, open source software still requires support and training costs, development plans may be less defined, standards adoption may lag and interfaces may not be as "user friendly."[liii]

Partly in response to Microsoft's monopoly of desktop operating systems, many IT companies have pursued open source software solutions such as Apache[liv] and LINUX.[lv] Likewise, countries including China, South Korea, India, Brazil and Thailand are promoting the use of open source software to reduce costs, control dependence on foreign suppliers, wring concessions from proprietary vendors, and enable "home-grown talent" to produce localized versions of open source software when it is uneconomical for proprietary software vendors to do so.[lvi] In sum, the open source approach is an emerging

and increasingly robust alternative to proprietary software solutions. It is particularly threatening to Microsoft since the open source approach provides the only real challenge to Microsoft's monopoly of operating systems and office productivity software applications.

Open Standards: Open standards have been used around the world for many years and exist where multiple vendors and organizations agree to the specifics of a particular technical standard. All vendors can then use the technical standards in their products or services. Usually a third-party industry group or professional group maintains the open standard on behalf of the larger community. As with previous technological advances, open standards play a key role in the adoption of information technology. For example, the TCP/IP communications standard that underlies the Internet is an open standard. Likewise, the HTML standard used to deliver web pages is an open standard that anyone can use to deliver web content via an HTML-based browser. The availability of these Internet standards to many different companies and individuals fostered the widespread adoption of the World Wide Web. However, just because a standard is widely adopted does not necessarily make it an open standard. For example, Microsoft's office applications use proprietary document format standards, and only Microsoft has the right to use these standards as the default document format for office productivity software.

One of the most promising of open standards is called the eXtensible Markup Language (XML), which aims to provide an open standard for representing both web and office document content. Over five years ago the World Wide Web Consortium (W3C) introduced the XML as a tool to describe all kinds of data.[lvii] Originally designed to enhance web services, XML is now used for many data sharing functions and has been called "the future lingua franca for the exchange of structured data."[lviii] XML is the key candidate upon which to base an open next-generation format for use across the web and on the desktop. Even Microsoft is supporting XML in their upcoming release of Microsoft Office, although critics charge that Microsoft is keeping their specific XML implementation secret in an attempt to continue to lock users into a proprietary solution under Microsoft Office.[lix] Despite these disagreements, it is probable that office productivity document standardization efforts led by the Organization for the Advancement of Structured Information Standards (OASIS) will lead to a future where data interoperability across platforms and applications can be the norm and not the exception.[lx]

Microsoft's Monopolies: One of the most singular aspects of the modern information age world is that one company – Microsoft – holds an overwhelming monopoly on the basic operating software used to run most of the world's desktop computers, along with a virtual monopoly on the office productivity software used throughout the world. While this dominant position has no doubt driven and enabled widespread adoption of information technology, it raises issues of sole-source dependence, security vulnerabilities, lack of innovation, and monopoly abuse.

Microsoft Window's operating system monopoly erects formidable barriers to other vendors wishing to enter the market. Potential competitors must offer a better product, and, more importantly, figure out a way to overcome the network benefits that Windows accrues from its dominant position. Another barrier to competition in the operating system market is that potential Windows competitors must offer not only an

attractive operating system, but also a compelling office productivity suite that meets or exceeds the features and network benefits of Microsoft Office. The reinforcing combination of the Office and Windows monopolies erects an almost unassailable wall to other software producers. This combination will allow the Windows' monopoly in particular to linger beyond its natural lifespan.

If these were the only barriers to entry, it is possible no antitrust actions would have been sought against Microsoft. What has prompted such suits is Microsoft's abuse of their monopoly position. While monopolistic positions may be tolerated for public good, what is prohibited is using monopoly advantage to stifle competition and innovation. Such behavior hurts consumers in the long run because competition is stifled, which means prices increase and innovation stagnates.

Both the US[lxi] and the EU[lxii] won anti-trust lawsuits alleging illegal bundling software, such as Internet browsers and media players, in Windows. Microsoft attempted to bundle additional functionality into their operating system as a way of dominating new software markets. This practice of bundling is a common symptom of monopoly abuse.[lxiii]

The challenge of dealing with Microsoft is many-faceted. Microsoft provided a real benefit with their Windows/Office market dominance by spreading the use of personal computers through network effects. The world and the US experienced faster information flow and increased productivity as a result.

Microsoft attained their monopoly position legally, and they deserve the rewards of a successful technical and business strategy. The question is whether they should continue to hold this dominant position given the potential for pricing abuses and stifling innovation. Certainly other vendors are motivated to bring innovative and potentially competitive products into this market. But they are unlikely to succeed against the combination of Microsoft's legally built Windows/Office monopoly and Microsoft's anti-competitive actions as documented in the courts. Thus, while a Government-made level playing field did not bring the US or the world to the Information Age, it is important for the Government to ensure a fair playing field where products and solutions compete on the basis of price and innovation alone.

Recommendations: 1. In the United States, the Justice Department and Judge Kollar-Kotelly should continue to closely monitor Microsoft's business practices. The primary goal is to prevent any further attempts to illegally bundle new capabilities into Windows or Office that other vendors might reasonably provide separately. 2. A secondary goal is to ensure Microsoft does not inhibit the use of open standards by "adopting" such standards, and then building in proprietary components that serve to perpetuate a Microsoft monopoly. Stopping Microsoft from using their monopoly position to gain unwarranted dominance in new product areas and ensuring Microsoft does not undercut the adoption of open standards enables innovation, competition and interoperability. These actions do not stop Microsoft from competing in new areas, but instead allow consumers to benefit from having multiple vendors compete to provide best-value products or services. 3. Also, Federal and State Government IT procurement requirements should be *neutral* with respect to software development approach, with an emphasis on the use of open standards to achieve interoperability. In particular, requirements for operating systems and office productivity software should be not exclusively mandate the use of specific proprietary products or the use of open source

software – both approaches should be considered. Setting IT standards that do not mandate either proprietary or open source solutions allows vendors to put together best-value solutions independent of the particular software development. 4. Finally, we should promote the use of open office productivity software document standards by having the Commerce Department require Microsoft to turn over their Office document formats to an international standards group so any software vendor can use them. In addition, Federal and State Government IT offices should eventually move towards adoption of emerging XML-based open data formats. Moving to an open set of document standards (first based on Office formats and potentially migrating to open XML-based formats) will immediately allow other vendors to develop applications with various feature and prices sets that would compete with the existing Office applications. All vendors, Microsoft included, will then compete on best price/value based on tailored applications, instead of one vendor selling a monolithic suite with no competition. This a also reduce one of the main barriers to competition with Microsoft Windows.

IT Worker Shortage

The IT industry has stated that there is a shortage of workers with the IT skills necessary to keep their organizations competitive locally and globally. In the past four years, there has been the dot-com collapse, the telecom collapse, a recession and the subsequent jobless recovery, until recently spending on IT services and equipment has been slow.

The Information Technology Seminar made numerous visits made to IT associations (lobbyists) and IT companies. Most lobbyists and companies alike asserted that a shortage of qualified IT workers exists in the United States and can only be filled by foreign workers (at least short-term).

There are well over 100,000 programmers unemployed in the United States, and nearly 600,000 unemployed IT workers. According to data from the Bureau of Labor Statistics, unemployment in 2003 for all IT workers averaged 5.6%, with a 6.4% rate for computer programmers. (McGee). Economists generally agree that there is NO shortage of IT workers.[lxiv] A basic tenet of capitalism is that if there were a shortage, wages would rise. Businesses and even universities have used the H-1B and L-1 visa programs to replace American workers, or to avoid hiring them in the first place.[lxv] Workers are available, but not at the price that companies want to pay. They have used the Congress and other parts of government to obtain cheap sources of labor.

Another related issue is the "shortage" of engineers and scientists in the United States. Predictions of a shortage of nearly 675,000 scientists and engineers in the United States in the 1990's never materialized and were wholly inaccurate. In fact, National Science Foundation (NSF) Director Neal Lane, in Congressional testimony, repudiated projections and stated that the shortage alarm had no basis.[lxvi] Unfortunately, Congress had by that time nearly tripled the number of permanent visas for highly skilled immigrants.[lxvii] It could be deduced that the role of bringing in students to receive PhDs and then retaining them was really to hold down salaries of American students earning PhDs. Salary restraints further reduce the attractiveness of PhDs to American students, which may *artificially* reduce American enrollment.[lxviii] In fact, a PhD does not presently pay for itself over a lifetime of earnings.[lxix]

VISAS: The H-1B visa program was introduced in 1990 in response to a perceived shortage of skilled labor in the U.S.. H-1B visas allow companies to bring in foreign college-educated workers for six years, but they cannot replace American workers, and they must be paid at prevailing U.S. wages. However, employers are not required to recruit Americans before hiring H-1B recipients.

The laws which require H-1B employees to be paid at the prevailing wage are so full of loopholes that they are virtually unenforceable. Additionally, the restrictions in the H-1B have failed to protect U.S. workers and IT workers. (Matloff, Worthen). A prominent and profitable Silicon Valley company applied for 4,000 H-1B visas. After the visas were approved, the company announced layoffs of 4,000 U.S. (but only after some were required to train their replacements).[lxx]

Only 78,000 H-1B visas approved last year. Universities and non-profit institutions have no limits and are exempt from any cap.[lxxi] There are currently over 450,000 H-1B visa workers in the country and the vast majority is in the IT industry (recall that there are over 600,000 unemployed IT workers).[lxxii]

Another temporary work program is the L-1 visa program. L-1 visas are available for global companies to transfer personnel around the world. Global companies need this ability to transfer people around various departments located in different countries. L-1 visas have almost no restrictions – no labor restrictions and no annual cap. The program has been abused in recent times to bring programmers from India.[lxxiii]

Numerous lobbyists and companies have claimed they need special skill sets that are not available in the United States.[lxxiv] This claim does not fit with statistics showing reduced salary of H-1B visa applicants. It is a leap to believe that the "best and brightest" from around the world are flocking to the United States for substandard salaries. According to the Bureau of Labor statistics, 99 percent of I.T. related H-1B visas salaries are less than $79,000 per year. Furthermore, only one percent of computer related H-1B visas have doctorates. Few H-1B visa recipients have Masters degrees, either.. [lxxv] Therefore, based on salaries and qualifications, it is clear that the very large majority of H-1B visas are extended to ordinary foreign workers that are paid below prevailing U.S. salaries.

Recommendations: 1. Numerous Bills are before Congress to reform the H-1B and L-1 Visa program (Mica Bill, DeLauro Bill, Dodd/Johnson Bill, and the Tancredo Bill).[lxxvi] None of these bills are completely satisfactory. Wage parity requirements and stricter justification of workers are a good starting point. No exemptions should be granted for H-1B visas (i.e. universities and non-profit institutions should hire Americans as well). Employers should be required to advertise the position for 3 months in a national medium or database.[lxxvii] L-1 visas should be completely revised as well and require justification to transfer personnel – vice hiring someone locally (the justification should be along the lines that a unique individual with experience in that company is required to execute the job). 2. There is no shortage of engineers or scientists in the United States. However, it is recommended that the total number of American students enrolled in PhD programs (engineering and science) be increased to ensure the United States maintains the capability of continued excellence in R&D and innovation.

Offshore Outsourcing: Offshore outsourcing is the contracting of IT work to companies outside of the U.S. In recent years, offshore IT contractors have demonstrated that they can provide many quality services for lower costs than are available in the U.S. In an effort to cut costs, many U.S. companies have started outsourcing work to India, China, and Eastern Europe, where wages are between 30 and 80 percent lower than in the U.S. (Frauenheim, Overby, Heeks, Murphy, Wilson). Indian firms now develop software for almost one-third of the Fortune 500 companies (i.e., Procter and Gamble, General Electric, American Express) and recent surveys show that the trend towards offshore outsourcing is rising. (Heeks, Koch, James, Messmer, Wilson, Chandras)

The amount of work being exported overseas is not insignificant. India, the largest overseas recipient of offshore IT work generated service and software exports of $6.9 billion from April to December 2002. (McLaughlin) This year, the IDC predicts that $16 billion in IT services will be imported, and by 2007 that number will rise to $46 billion. (Ferranti). Forrester Research estimates that "by 2015, some 3.3 million U.S. jobs and $136 billion in wages will transfer offshore to countries including India, Russia, China, and the Philippines".[lxxviii]

Advocates believe that offshore outsourcing is a win-win scenario where the U.S. gets the benefits of skilled cheap labor and the demand for U.S. software and hardware products increases as offshore companies invest to improve their infrastructures and interoperability. Corporations argue that globalization is ultimately good for our economy. Sunil Mehta, Vice President of the National Association of Software and Service Company in India, estimates that US companies can save up to 11 billion dollars in 2004. At the same time, India will import approximately 3 billion in high-tech merchandise from the US. (Koch)

Opponents to offshore outsourcing argue that the loss of IT jobs in the U.S. will lead to an erosion of those skills. Gartner estimates that by the end of 2004, one in 10 IT jobs in IT intensive companies in the US and one in 20 IT jobs in non-IT intensive companies will move overseas. (Koch) Opponents claim that technology jobs are following the path of the manufacturing industry where over the last 30 years; millions of jobs were sent offshore or eliminated. They also argue that as technology jobs move offshore, the "deep, experiential knowledge that comes from coding applications and solving technology problems – the soil of technological innovation" will erode in the US. (Koch) is difficult to recruit computer science majors when all of the entry-level positions that are necessary to gain experience and develop more advanced skills are being exported. This erosion of IT skills can even have an impact on our national security. "If historical precedents are of any validity at all, the most critical constraint upon any 'surge' in wartime production has usually been in the area of skilled craftsmen." (Kennedy p. 530)

Opponents also cite security concerns with exporting IT work overseas. Issues such as ensuring the integrity of corporate data, safeguarding proprietary information and the possibility of trapdoors and Trojan horses have the potential to create large security breaches. Although India is making strides to adopt international data privacy rules, they have little case precedents. Other countries that engage in outsourcing (China, Philippines) have horrible records at protecting intellectual property or data rights. (Overby, p. 28, Fitzgerald) A cyber-terrorist working at a company in India may be able to insert a security vulnerability into a program that could be exploited to create

economic and in some cases military damage. The possibility of the U.S. government and the military using Commercial-Off-The-Shelf (COTS) products developed in whole or in part overseas is becoming greater.

Opponents of offshoring cite genuine concerns that need to be addressed and managed. However, outsourcing to firms with particular expertise is a wise business decision. Offshoring to maintain a competitive position in the market place may be a similarly wise business decision and is a trend expected to continue and grow.[lxxix] Unlike abuses in the H-1B and L-1 visa programs, there is very little that can be done to prevent offshoring.[lxxx] Furthermore, if market conditions require offshoring, interference would simply cause U.S. companies to become less competitive. In addition, offshoring can and is used to establish a presence in a market – which expands and creates additional business. If slowing down this offshoring trend is desired, U.S. policies must provide some financial incentives to offset the advantages of offshoring.

Recommendations: Policies that provide financial incentives, comply with WTO commitments, and minimize and slow down the rate of offshoring should be implemented to allow U.S. workforce time to adapt, increase productivity, and compete. Ultimately, market forces will determine the most productive and cost effective locations.

IT Convergence Implications

Largely due to technology convergence, data communications growth and performance have become increasingly more important than computer processing power or speed. Three major trends driving the future of networks and data communications are pervasive networking, integration of voice, video and data and new information service applications and protocols.

Pervasive networking: Computer networks and network devices are everywhere and growing at an explosive rate. Virtually any networked computer or device can communicate with any other device throughout the world. This technology will continue to revolutionize and transform the way we live and interact throughout the world. This so called "age of convergence"[lxxxi] may be stalled in the U.S. due to last mile distribution issues, broadband development, regulatory issues and geographical dispersity problems. It is likely to take until 2007-2010 to provide most homes with high speed, low cost internet connections.[lxxxii] What used to be a market split by different technologies into different networks is now moving to linked sets of networks capable of delivering the same or similar services.[lxxxiii] Data, voice and video will soon be available from various sources such as cable, wireless, wireline, and satellite, which means that companies that would not have been head-to-head competitors in the past will increasingly compete against each other. So wireline (phone and cable) leaders such as Alcatel, Lucent, Nortel, and Cisco will increasingly compete with wireless leaders such at Motorola, Lucent, Nokia and Ericsson to provide cross-cutting digital technology equipment.[lxxxiv]

With the on-going convergence, it is difficult to determine market share since the definition of the market itself is in flux. This is leading companies in this sector to move outside their traditional comfort zone to pursue a market strategy that provides a variety of digital services via their products. Traditional measures of performance (return on investment, return on equity, etc.) may also be less important during this convergence phase. Just as important will be breadth of technology offerings (data, voice, video) that

are appealing enough for companies to remain a player in a converged communications equipment market. The market is increasingly characterized more by the specific services provided than by the technology or delivery medium.

Integration of voice, video and data: Cellular telephone networks are competing with wired network services and electronic information exchange is used more extensively than voice communications. The integration of voice and data is mostly complete, but video integration over computers is lagging mostly due to past legal restrictions and the immense communications capacity needs of video. Broadband connections to the internet are growing at a 50% annual rate and quickly overtaking dial-up service. Broadband has penetrated more than 50% of the internet market (including 75% of U.S business workers) [lxxxv]. Approximately 63% of broadband connections are made through cable modems and 37% via DSL.[lxxxvi] The National Cable and Telecommunications Association estimates as of the 3rd quarter of 2003, there were 15 million cable modem customers with significant capability to increase as cable modem service passes by approximately 90 homes.[lxxxvii] The number of broadband DSL users grew 78% worldwide last year, with North America at an estimated 11 million users. DSL gains were a result of lower prices over cable and increased line accessibility due to a lifting of line-sharing requirements by the Federal Communications Commission.[lxxxviii] Wireless currently has a negligible share of the market, serving primarily in the low-density rural areas. Fixed wireless (Wi-Fi – wireless fidelity) is an emerging technology. It is high speed (54 Mbps) but limited to 2,000 feet coverage from its individual access point. By 2007, 5.4 million people will use Wi-Fi[lxxxix].

Recommendation: OMB designate the DOD Chief Information Officer (CIO) as the Executive Agent to develop and disseminate an enterprise or joint technical architecture document which provides industry an overview of how the federal and defense departments intend to use various new network devices. This architecture will help industry develop systems which fit government needs and help the government plan how best to take advantage of wireless implementations to reduce overall network infrastructure costs and enhance military operations.

New information service applications and protocols: Extensible Markup Language (XML)t is designed to improve the functionality of the Web by providing more flexible and adaptable information identification. Originally designed to enhance web services, it is now used for many data sharing functions."[xc] XML (and its extensions) is the key candidate upon which to base an open next-generation format for use across the web and on the desktop. XML is intended to make it straightforward to define, author and manage documents, making it easier to transmit and share them across the Web. XML if not just for Web pages; it can be used to store any kind of structured information and to enclose or encapsulate information in order to pass it between different computing systems which would otherwise be unable to communicate. For many applications and services, XML provides an interoperability bridge between different vendor products. XML also allows the flexible development of user-defined document types and provides a robust, non-proprietary, persistent, and verifiable file format for the storage and transmission of text and data, both on and off the Web. [xci]

Sun Microsystems and associations such as the Open Office Organization have defined an XML-based format for their office software suites, promising that it will be available under an open and free license so that other XML applications can use the

data.[xcii] Even Microsoft is supporting XML in their upcoming release of Microsoft Office, although critics charge that Microsoft is keeping their specific XML implementation secret in an attempt to continue to lock users into a proprietary solution under Microsoft Office.[xciii] Despite these disagreements, it is probable that office productivity document standardization efforts led by the Organization for the Advancement of Structured Information Standards (OASIS) will lead to a future where data interoperability across platforms and applications can be the norm and not the exception.[xciv]

In the area of network enterprise management, XML is new application technology that can also be used to provide better management and control of enterprise tools such as firewalls and load balancers. The Vice President of Intelliden, Jeff Chapman, suggests that the "XML technology will help alleviate the complexity of managing large enterprise networks". As router protocols reach inside the enterprise and interior gateway, they become more complex and require more sophisticated management tools. As the government moves toward network centricity, more powerful network management and transport tools are needed to study, configure and predict routing to approach a state of true self-configuration and self-healing. XML can lead in this regard.

Recommendation: The Federal CIO should oversee the investment of R&D funds designed to further define, develop, test and field XML-enabled capabilities to bridge the information gap between legacy (stove-pipe) databases (Medical, Personnel, Logistics, Finance etc.). Additionally, XML technology should be tested in warfighter Advanced Concept Technology Demonstration (ACTD) projects to pass information from machine-to-machine (vice manual entry) by using standard sets of data fields to overcome meta-data documentation and incompatibility problems. Furthermore, XML may be helpful in developing advances in the area of network centric warfare by automating intelligence surveillance and reconnaissance sensor operations to help fuse battlefield information for key decision makers.

Moving to an open set of document standards (first based on Office formats and potentially migrating to open XML-based formats) will immediately allow other vendors to develop applications with various feature and price sets that would compete with the existing Office applications. All vendors, Microsoft included, will then compete on best price/value based on tailored applications instead of having one vendor sell a monolithic suite with no competition. As a side benefit, this would also reduce one of the main barriers to competing with Windows.

IP Next Generation (IPng): Ipng offers the next big change to the Internet at the transport layer. The original designers and developers of TCP/IP never envisioned and probably never could have anticipated the extreme growth that the Internet has seen in the past decade. In the early 1990s, it was evident that Internet Protocol version 4 (IPv4) addressing and routing (due to backbone routing table growth) would break down in the near future. The primary driving force behind the development and the adoption of IPng was the impending exhaustion of the IPv4 32-bit address space due to the rapid growth of the Internet. The new IP version needs to support the large global inter-networks that exist now as well as the large amount of growth that will undoubtedly occur in the future. Over the past 3-5 years, the size of the Internet backbone routing tables has become a critical concern. If the routing tables were to become too large, there would be no way

for the backbone routers to store them. In 1993, "the backbone routing table was growing at a rate about 1.5 times as fast as memory technology." [xcv]

An important design goal of IPng was to allow for efficient routing, route aggregation, and hierarchical address assignment. Under the term *Expanded Addressing and Routing Capabilities,* the IP address size is increased from 32 bits to 128 bits. This will provide support for many more addressable networks, nodes, and addressing hierarchies. IPng also includes *Required Support for Authentication and Privacy,* extension service provides support for authentication and data integrity. Security in IPng is an important issue because the risks in today's electronic world have increased exponentially and drive the demand improved security. IPng includes much awaited *Quality of Service Capabilities.* A new capability is added to enable the labeling of digitized packets belonging to particular traffic flows for which the sender has requested special handling (such as non-default quality of service or real-time service).

Enabled by IPng protocols, *Class of Service (CoS)* is a way of managing network traffic by grouping similar types of traffic (for example, e-mail, streaming video, voice, large document file transfer) together and treating each type as a class with its own level of service priority. Having the capability in network transport routers to classify services will give customers the ability to better manage their network bandwidth and application resources. Similar to CoS, *Quality of Service (QoS)* features offer a way to allocate bandwidth from the customer's network across the wide-area network.[xcvi] QoS carves out a portion of available bandwidth and allocates it to the specific user. This allocation allows the service provider to measure traffic performance across the wide area network (WAN) and make incremental increases/decreases in bandwidth if throughput performance is degraded. A combination of CoS and QoS features allow enterprise service providers and managers to "guarantee service performance and availability". [xcvii]

Multiple Protocol Labeling Switches (MPLS) is another popular routing enhancement service which is growing in popularity. It speeds up the network routing process by moving data based upon simple labels rather than a full IP address-based routing table decisions. Although routing/switching hardware has become much faster, MPLS offers network service providers the ability to build one network and use it to offer completely independent and separate services. Build once, sell many times…a concept any service provider love. Because MPLS service can also be provided over any medium its popularity is growing, but implementations are still very complex and require homogeneous WAN components.[xcviii]

Enhanced network performance techniques, enabled through new protocol services, are critical capabilities needed in next generation networks (NGN). Simplified, but powerful web communication services like XML and next generation networking protocols like IPng, CoS, QoS, MPLS and others are sorely needed to handle the continued growth and complexity of future systems. As new information services are developed, computers become more pervasive, and data, voice and video services converge the methods used to more efficiently move and manage data throughout a WAN grow in importance.

Recommendation: ASD NII establish an Internet Protocol Next Generation task force to guide DOD planning and implementation in this area. The task force should be comprised of members of each service, key government agencies and industry. The task

force should focus on designing a voice, data and video convergence plan to make use of the global information grid. The plan should define the types of transport services, traffic engineering and management services envisioned to be used throughout the federal government's classified and sensitive but unclassified network enterprises. Following this overarching plan can help ensure the network upgrade and procurement efforts of the entire federal government can become better synchronized. Industry involvement will ensure their R&D investments are better focused on federal customer needs.

Encouraging IT Investment and Innovation

R&D Tax Credit: Congress originally enacted a temporary tax credit in 1981 in response to a decline in R&D spending relative to GNP. Since original passage, Congress has modified it incrementally and extended it eleven times, five retroactively.[xcix] The current tax code allows firms to claim a 20% credit for qualified research expenses exceeding a base amount. The computation for the base amount relies on a measure of research intensity during 1984-1988.[c] This defined base period complicates computation of the credit for the numerous new entrants to the IT field. "Start ups" yet to establish a research track history end up using a much less attractive alternate credit. The current credit has been an effective method to spur increases in R&D without "picking a winner". A recent ITAA survey showed 45% of their members stating that that some of their products or whole technologies would not have been funded without the credit.[ci] However, the current R&D credit structure suffers from uncertain political time horizons and a complicated structure that penalizes the numerous new entrants to the IT industry.

The President's FY 2005 budget request includes a provision for making the tax credit permanent. In early March 2004, the Senate responded with a unanimous vote to extend the current June 2004 deadline to December 2005.[cii] Given the current state of the federal deficit and the stigma attached to pro-business tax treatment in an election year, an extension is likely the only reasonable expectation this year. The economic case still argues for a permanent credit that firms can count on in planning their long-term innovative research efforts. A Coopers and Lybrand study concluded that simply making the credit permanent would increase R&D investments by $41B through 2010.[ciii] The U.S. can firm up its IT leadership position by streamlining the R&D tax credit and making it permanent.

Recommendation: To encourage IT innovation, Congress should immediately make the R&D Tax Credit permanent.

Intellectual Property Rights.

Intellectual property protection has always been important to individuals and corporations. However, for the IT industry protection of intellectual property (IP) can be critical to the survival and growth of companies. If a company cannot protect its IP, it will not thrive and innovation will cease – since a reasonable return on investment of the development of new technologies becomes impossible. Theft of intellectual property (including by piracy) is costing U.S. corporations billions of dollars in lost revenue. Even more worrisome are patent infringements and wholesale theft of processes from U.S. corporations.[civ] Patents and copyrights form the basis of intellectual property protection. International treaties hold great promise if enforced. In addition, the

international centralization of patents and copyrights by participating nations helps ensure the broadest protection of intellectual property. The World Intellectual Property Organization (WIPO) is one of 16 specialized agencies in the United Nations and can be an effective watchdog and promoter of IP protection. Activities such as the World Intellectual Property Day help create awareness of the value of protecting intellectual property to the public.[cv] As we transform into a knowledge-based economy, protection of IP must become an important national interest, reflected in our foreign and trade policies. However, U.S. policymakers must understand that the concept of intellectual property is not universal and there are wide disagreements even among western nations regarding IP and what levels of protection it should be afforded. As a result, negotiation is the principle tool that will need to be employed in protecting U.S. intellectual property. Ultimately, the World Trade Organization (WTO) will be the most effective organization to protect intellectual property (most nearly universal with 145 member countries), but the U.S. needs to take small regional and bilateral steps now to set precedents now and frame the standards in the WTO.

Recommendations:

For the Department of Trade, in coordination with the Department of State:

1. Pursue the establishment of Bi-lateral agreements with all of the U.S. trading partners (and update those that exist) to include provisions for protecting Information Technology and Intellectual Property rights.
2. Track and report on international initiatives that affect US industry.

For the Department of State:

1. Engage the World Trade Organization to press for the leading regional software pirates with sanctions (China, Japan, Russia, Pakistan, India).
2. Engage the International Monetary Fund to add monitors and increase the reporting on the economic performance of nations identified on a "watch list".
3. Increase the funding for US Agency for International Development (USAID) to deploy additional teams to countries identified on the watch list.

For the Department of Homeland Security:

1. Task the Information Analysis and Infrastructure Protection (IAIP) to include software piracy and IP violations on the list of Cyberspace Security reportable watch items.
2. Track the number of IP violation incidents within the Information Sharing and Analysis Center (ISAC) – Information Technology
3. Task US Customs to inspect incoming products for IP violations
4. Use National Intelligence assets to track and monitor the activities of identified piracy violators within the

ENDNOTES

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[iii] Department of Commerce, "Digital Economy 2003 (DE2003)," p11.
[iv] Raymond James & Associates, "The IT Supply Chain Fourth Quarter IT Demand Survey," p2.
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[viii] Department of Commerce, "Digital Economy 2003 (DE2003)," p19.
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[xxvii] Graham-Hackett, Megan. "Standard & Poor's Industry Surveys Computers: Networking", p1.
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[xxix] Graham-Hackett, Megan. "Standard & Poor's Industry Surveys Computers: Networking", p1.
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